Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters	)	WT Docket No. 10-4
	)	

COMMENTS ON NOTICE OF PROPOSED RULEMAKING

Bird Technologies Group ("BTG"), consisting of Bird® Electronic Corporation and TXRX Systems Inc. ("TX RX"), pursuant to the Commission's Notice of Proposed Rulemaking ("NPRM") of April 6, 2011[1], hereby respectfully submits its comments in the above-referenced proceeding.

Company Background

Bird Technologies Group is a global innovative supplier of RF products, systems, services and educational solutions. Bird specializes in developing and manufacturing products that serve both the management and measurement of radio frequency signals. TX RX has established itself as a leader in the design and manufacture of signal boosters, tower top amplifiers, transmitter and receiver multicoupler systems, duplexers, cavity filters, and a vast range of RF components primarily serving the public safety market where reliable, mission critical systems provide life saving communication.

TX RX, with more than 30 years experience serving critical Public Safety needs, has earned an unrivaled reputation for delivering high quality, reliable systems that enhance and extend the range of radio communications to basements, subways, high-rise building and other locations where obstacles challenge life saving communications. TX RX Systems is the supplier of choice to major radio system OEMs in North America. The equipment designed and manufactured by TX RX is the standard for interference mitigation and high-performance in many small, medium, and large enterprise communications systems as well as mission-critical, agency-wide, county, city and statewide communication systems. TX RX's resume of projects

[1] FCC 11-53, released April 6, 2011

includes the New York City Transit System, Hoover Dam, Department of Homeland Security, State of Pennsylvania, Washington MTA, University Health Care System (NC), Los Angeles MTA, Los Angeles Detention Center and Harbor, Disney, Cook County, Coors Brewery and many others.

TX RX is a leader in the specialized field of signal booster design and manufacturing and has the distinction of being the first American manufacturer that offered complete, fully integrated signal booster systems. Since its deployment in 1980, the first TX RX signal booster system has provided uninterrupted radio service deep inside a coal mine in the Midwest. Today, TX RX has thousands of units in use around the world as a vital part of two-way radio, paging, data transmission, telemetry and control systems operating on frequencies from 132 to 960 MHz. Applications include communication systems for major international airports, high-rise buildings, subway systems, hydroelectric dams, copper and coal mines, aircraft carriers, nuclear reactor containment buildings, and the tunnel under the English Channel.

Summary

BTG applauds the Commission's actions in attempting to mitigate some of the interference caused by signal boosters. In the Commission's NPRM there were several proposed rules that should significantly reduce interference while ensuring reasonably priced communications coverage for both public safety as well as the public at large. Herein, we express our approval of several aspects of the proposed rules in addition to our suggested improvements.

Supports 5 watt ERP limitation

BTG supports the continued 5 watt ERP limitations listed in section 90.219 of the Commission's Rules for both Class A and Class B signal boosters. Increasing the signal booster power limit above the current limitations will certainly increase the potential for interference of several kinds. Not only does it raise the isolation requirement and make oscillation more likely and destructive, as pointed out in Jack Daniel's previous comments[2], but it can also increase

[2] "Higher ERP increases the isolation requirement and increases the possibility of high power destructive interference to themselves and co-channel licensees due to oscillation." Jack Daniel Reply Comments, filed March 8, 2010, at page 8.

other types of interference, such as generation of Passive Intermodulation (PIM) products. For every 1dB of increase in power level there is theoretically a 3dB increase in the PIM level. Unfortunately, no amount of filtering in the signal booster can eliminate PIM products, as they are generated by the distribution system and even the environment (rusty drop ceiling lattice, etc). Thus, to limit additional interference, power limitations should stay as currently listed in the Commission's Rules.

Supports Class B Signal Boosters

BTG supports the Commission's decision to continue to allow the use of Class B signal boosters in confined areas in both rural and urban areas. However, BTG does not agree with the Commission's proposed rules limiting their use to only these confined areas.

BTG currently provides coverage solutions using both Class A and Class B signal boosters. In BTG's vast experience, we have found that in almost all instances, interference has been found to have been caused by poorly installed or poorly designed signal boosters. This is true of both Class A and Class B signal boosters.

Unfortunately, Class B signal boosters have gotten a bad reputation due to an abundance of consumer grade Class B signal boosters with poor filtering characteristics. Because of their poor filtering characteristics, these consumer grade signal boosters can emit significant RF energy into adjacent frequency bands, causing interference for the systems operating in such bands. However, when properly designed, Class B signal boosters should not cause any more destructive interference than Class A signal boosters.

Class A signal boosters still have potential to cause interference. These boosters typically come with higher available gain, which make them more likely to oscillate due to the increased isolation requirements. Also, a Class A signal booster typically supplies a higher power level to each intended channel. Since most Class A signal boosters use a single shared power amplifier, and intermodulation (IM) products increase 3dB for every 1dB increase in power, a Class A signal booster also can create a higher level of in-band interference from IM products.

Another form of interference can be created by multipath. All signal boosters can create areas of multipath, where the macro signal and the boosted signal are both present at similar power levels. However, Class A signal boosters can pose a much bigger problem since they have sharply defined filter cutoffs that introduce significant delay to the boosted signal, resulting

in greater inter-symbol interference in those areas of multipath. These areas of multipath can be moved by arranging antennas and varying output power, but many times it just moves the problem outside of the building.

Typically the decision to deploy a Class A or Class B signal booster is a balance between cost and required performance to meet the demands of the specific RF environment. Class B signal boosters can be a much more cost effective means to provide coverage, as they typically consist of only amplification, control, and interface circuitry. Class A signal booster designs require additional circuitry such as analog to digital converters, field programmable gate arrays, digital signal processors, digital to analog converters, as well as frequency conversion circuitry. This can add significant cost to the booster as compared to a Class B signal booster. We have found in many circumstances the performance of Class B signal boosters to be more than adequate to meet the coverage needs of our customers.

BTG also supports the Commission's intentions to allow Class B signal boosters with external antennas to provide a return path to the licensee's base or repeater station. However, BTG would like to see this fact specifically itemized in the Commission's rules in section 90.219. In addition to the reasons mentioned above, Class B signal boosters shouldn't cause additional interference since a very limited number of in-band frequencies (besides those of the licensee) would be present inside of the building to be transmitted outside.

Certification

Part 2 of the Commission's Rules was never updated to add a section devoted to signal boosters and the Commission's labs never recognized them as a separate equipment class, but rather certify them as a "non-broadcast transmitter" or "amplifier." The only indication that the device is to be used as a signal booster is placed on the equipment certification as a comment. Furthermore, there has never been an indication on a Part 90 certification as to whether the equipment is Class A or Class B. BTG suggests that the Commission's Rules in Part 2 and Commission Forms be updated to more clearly define the certification of signal boosters.

Expansion of Emissions Masks

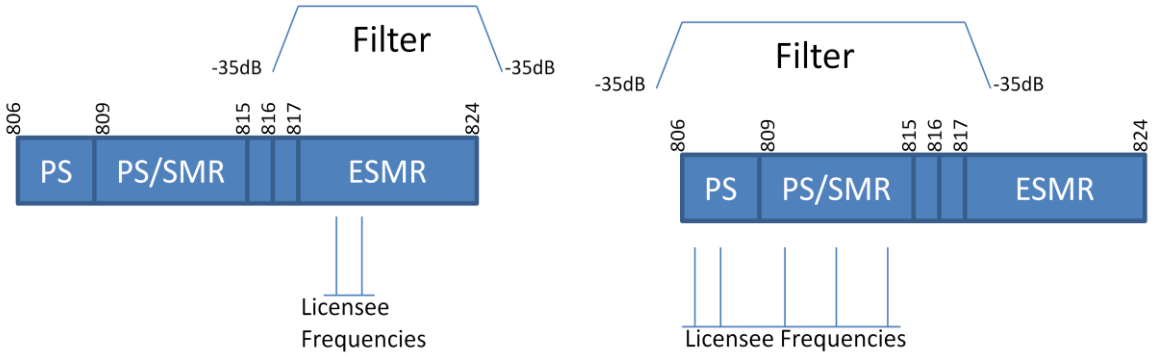
In the Commission's discussion of Class A and Class B signal boosters the Commission specifically asked for comment as to whether the emissions masks of Section 90.210 should be

modified for signal boosters. It is BTG's opinion that the emissions masks should not be modified. The emissions masks described in Section 90.210 are not meant to regulate what frequencies pass through and get amplified by a signal booster (Class A or Class B). Rather these Rules are meant to regulate the generation and transmission of unwanted frequency components such as intermodulation products, mixing products, harmonics, phase noise, etc. In other words, the masks do not define filter characteristics, rather they define limits of spectral re-growth of an individual signal. The masks apply equally to Class A and Class B boosters, as defined by the emissions designator. Changing these emissions masks to instead regulate what frequencies are allowed to be amplified by a signal booster would have negative consequences. This would permit signal boosters (and other transmitters) to generate unwanted emissions (including intermodulation products and phase noise) at a higher level than currently allowed, resulting in increased interference. BTG supports defining filter characteristics for Class A and Class B signal boosters, but the masks of Section 90.210 are the wrong place to do so.

Definition of Signal Booster Filter Characteristics

For Class B signal boosters, George Potter's suggestion[3] of requiring the gain to roll off -35dB at 1MHz above the highest and 1MHz below the lowest licensed frequencies is a good baseline. However, implementing this could in many cases require a programmable filter similar to those currently used in Class A signal boosters. This would eliminate much of the cost advantage of using a Class B booster. Since the majority of the interference we have seen is between the desired frequencies and another adjacent frequency band, we suggest that Class B signal boosters be required to employ filters such that the gain of the signal booster rolls off -35dB at 1MHz above and below the smallest contiguous set of frequency bands that contain the licensee's frequencies.

[3] Comments of George Potter, filed February 5, 2010, at page 1.



In the case that the frequency bands containing the licensee's frequencies are not contiguous, the gain of the signal booster should roll off as we suggested above, in order to reject any frequency bands in between the bands containing the licensee's frequencies as well. Under current regulations, when an operator needs to extend coverage into a building for ESMR services, the operator may buy and install an 18 MHz wide standard signal booster. Such a booster will boost public safety bands as well, potentially causing interference to the public safety band licensees. Under the rules we proposed above, this would no longer be an issue, the operator would be required to only amplify the band for which the operator had licensed frequencies. We also suggest that this requirement be applied to Class B signal boosters on non-part 90 frequencies as well, by adding the requirement to Part 95 Subpart M.

The case for defining filter roll off characteristics for Class A boosters is more complicated. In many circumstances, widening the filter bandwidths of a Class A signal booster is the only way to reduce the multi-path interference. Under the Commission's current rules this would make the Class A signal booster into a Class B signal booster[4]. Since the Commission has proposed that under its new rules Class B signal boosters cannot be used in outdoor areas[5], this would make it impossible to use any signal boosters in many outdoor environments. Thus, the combination of the existing rules and the proposed new rules necessitates that the definition of a Class A signal booster be expanded to include the possibility of widening the filter skirts to reduce the group delay of the system. Just to reiterate, BTG opposes the restriction of Class B signal boosters to indoor applications only, but should the Commission choose to follow through with that restriction, then widening the definition of a Class A signal booster is necessary.

[4] 47 C.F.R. 90.7
[5] FCC 11-53, released April 6, 2011, page 30

Canam has suggested a bandwidth of 60kHz with ultimate rejection greater than 60dB at +/- 75kHz[6]. The challenge with utilizing specific parameters such as these is that the parameters vary per particular modulation scheme and application. What these multiple filter parameters really translate down to is a group delay curve across frequency. Various combinations of passband, rejection frequency, rejection amplitude, and pass band ripple (needed for different applications) can result in the same group delay curve. Likewise, various modulation schemes can tolerate various amounts of group delay and group delay variation over frequency. We have seen group delay requirements vary between 20 and 80 microseconds, which result in drastically different filtering capabilities. Thus, arriving at a specific set of filter characteristics that prove ideal across the various modulations and applications is not possible. We recommend that the class A channel bandwidth be the minimum technically possible given the modulation type and system delay requirements.

Part 95 Subpart M

BTG supports the new rules adopted in Part 95 Subpart M, in particular those pertaining to requiring the operator to coordinate the frequency selection and power levels with the licensee (Section 95.1619), as well as the new labeling requirements (Section 95.1625). These rules are very much in line with the intent of our Petition for Rulemaking submitted in 2005.[7] However, one concern is that mobile signal boosters seem to be exempted from the Part 95 Rules. While we realize that coordination of power levels may not make sense for a mobile signal booster, we are concerned that the licensee should still be aware of the use of a consumer signal booster on their frequencies so they can coordinate with the user in the event of interference. This is especially a concern to us regarding mobile CMRS signal boosters used on Part 90 frequencies adjacent to public safety frequencies, since they have the potential to cause interference not just to the licensee but also to nearby public safety licensees. We suggest at a minimum these mobile signal boosters should be required to be registered in the National Signal Booster Clearinghouse that was proposed in the Commission's NPRM.[8] Mobile signal booster users could be required to register (and keep updated) their general area of operation. This would also assist the licensee

[6] Canam Comments, filed February 5, 2010, page 7.
[7] Bird Technologies Petition, filed August 18, 2005.
[8] FCC 11-53, released April 6, 2011, pages 24-25.

(and nearby licensees) in solving any interference problems that could be caused by a mobile signal booster.

As mentioned above, poorly designed consumer signal boosters have resulted in a large amount of interference. The filters used in these products typically roll off very slowly resulting in adjacent bands being amplified by the signal booster. BTG suggests that the requirements suggested above for the Class B filter characteristics should be added to Part 95 Subpart M as well and apply to all signal boosters.

BTG Opposes Shutdown for Part 90 PLMR Signal Boosters

The Commission also specifically asked in its NPRM whether some of the rules in Part 95 Subpart M should be applied to Part 90 PLMR signal boosters.[9] While BTG sees no reason not to apply the same licensee consent and labeling rules to PLMR signal boosters, there are other rules in Part 95 Subpart M that should not be applied to Part 90 PLMR signal boosters. Specifically, the rules contained in Section 95.1623 should not be applied to Part 90 PLMR signal boosters. All three clauses specify that the signal booster must automatically shutdown in certain circumstances. Many PLMR signal boosters are used to extend radio coverage for public safety personnel. Loss of radio coverage to first responders is a critical issue. It is of utmost importance that the signal booster remains operational, even if it is out of compliance with technical parameters or oscillating intermittently.

It is also important to note that it can be very difficult for an anti-oscillation circuit to tell the difference with 100% certainty between a time varying high power desired signal and an oscillation. Thus, there is the possibility that a signal booster could shutdown in error, preventing public safety personnel from communicating. So, it is BTG's position that the Commission's Rules in Part 95 Subpart M should not be applied in their entirety to Part 90 PLMR signal boosters. In addition we would like to see the Commission's proposed rules in 90.219(d) clarified to further define "subscriber-based services" so there will be no confusion as to which signal boosters Part 95 Subpart M applies to.

Conclusion

[9] FCC 11-53, released April 6, 2011, page 35.

The Commission's proposed rules with the above mentioned additions and changes will go a long way towards reducing the interference caused by signal boosters in today's communications landscape. Bird Technologies Group respectfully asks that the Commission takes our views expressed above into account when drafting final rules in this proceeding.

Respectfully submitted,
BIRD TECHNOLOGIES GROUP